

Sapphire completes live trials

LIVE firing trials using the lightweight gunfire control system—now named Sapphire—developed jointly as a private venture by Marconi Radar Systems and Sperry Gyroscope have been completed at HMS Cambridge, the Royal Navy gunnery range near Plymouth. The equipment was used to control a Vickers Mk 8 4.5in gun, the combination achieving 100 per cent accuracy during the trials.

Four salvoes of four rounds each were fired against Rushton and sleeve targets being towed at some 250kt, target range varying between 3,000m and 5,000m. Of 13 operative rounds (one of the 16 burst early and the proximity fuzes of two others failed), 11 burst within 10m of the target and all 13 would—had they been proximity-fuzed high-explosive shells—have damaged a representative target aircraft. A shell from the Mk 8 bursting within 3m of the target would give a 95 per cent kill probability against a typical air-to-surface missile. In surface firing trials against a splash target at 10,000m range the three four-round salvoes were within a spread of 50m in azimuth, range spread on each salvo being some 150m and average salvo range varying from 200m short to on-target.

Sapphire is designed for any size of warship from fast patrol boats upwards, and can control surface-to-air missiles such as Seacat as well as guns. The equipment can easily be extended to operation of anti-ship missiles, one point in its favour being the use of a Sperry 1412 computer, which is the heart of the Exocet co-ordinate converter.

Negotiations with the Egyptian Navy to supply Sapphire have been in progress for three years, a decision between British and French proposals originally having been due at the end of May. The advisory defence council could not decide between the submissions, however, so the defence ministry instructed it to carry out further studies and report by the end of June. The results of this extension are now awaited.

There are two British offers to Egypt. One is to refit the six Russian-built Komar missile boats with Sapphire controlling two Oto Melara/Matra Otomat anti-ship missile launchers in place of the present twin Styx installations, and a Bmarc A.32 twin 30mm anti-aircraft cannon instead of the Russian twin 25mm gun. The second proposal is to supply nine Vosper-Thornycroft *Tenacity*-class fast patrol boats, Sapphire controlling an Oto Melara 76mm gun and four Otomat launchers. France is also offering Otomat and the A.32, but with Thomson-CSF Vega fire control.

The Middle East as a whole and South America are regarded as the

best potential customers for Sapphire, both for new vessels and for refit installations. The price depends on the particular variant and capability required, but a Sapphire to control one gun and a Seacat launcher would cost about £500,000. Delivery of production-standard equipment can be made in 18 months, i.e. less than the building time for a suitable vessel. The Royal Navy has taken an interest in the trials with a view to possible control of guns and Seacats, provided that sufficient money can be found.

Sapphire comprises:—

- A Marconi ST802 X-band four-horn static split monopulse radar with MTI (moving-target indication) signal processing and extensive ECCM (electronic counter-countermeasures) facilities including television back-up, variable pulse-repetition frequency and pulse length, ability to track a jamming target, constant false-alarm rate and frequency manually variable between 8.6GHz and 9.5GHz.

Ninety per cent-probability detection range for a 4m² fluctuating airborne target is 20km with MTI and 25km without. Minimum range is 350m. Detection of surface targets is naturally limited by the radar horizon, but a fast patrol boat can be picked up at 30km. The radar can deal with three targets in its area-search mode and allocate itself to track one of those (although threat evaluation would normally be provided by an action information organisation). The ST802 then acquires that target and tracks it. Accuracy during trials has been established at less than 3m in range and better than 1min of arc in angle. The predictor is supplied with good target information 3.4sec after tracking begins. The radar can also conduct an horizon search, being able to

detect a 0.1m² cross-section anti-ship missile sea-skimming at 5m height at a range of 11km.

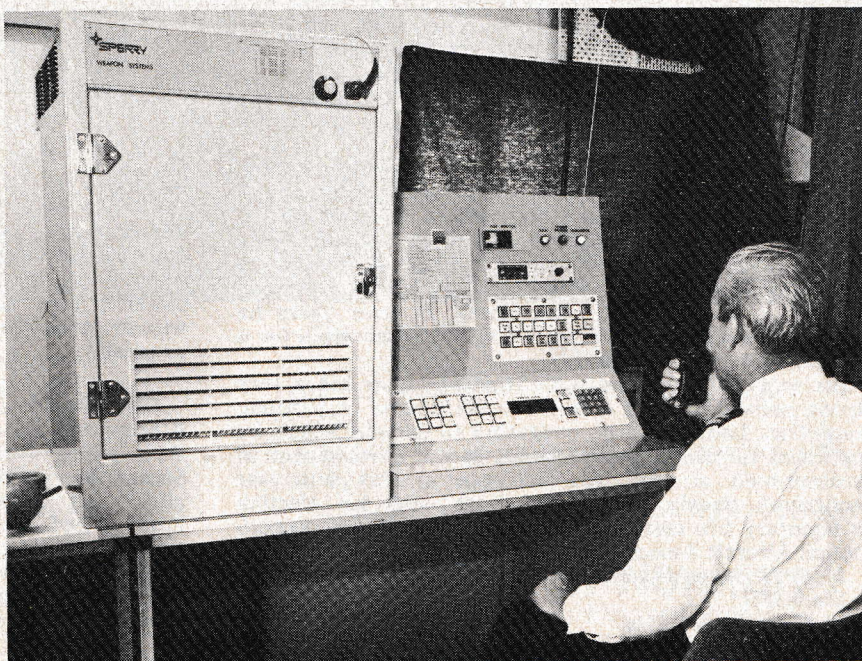
The ST802 underwent initial trials lasting six weeks in May and June 1973. Since then it has operated for 2,700hr at an availability rate of more than 99 per cent and it has never been off-line when needed.

- A Sperry Type DWC100 digital predictor based on the company's 1412 computer as used in the Exocet co-ordinate converter. The 1412 carries out the radar-target data processing, prediction, ballistics and—in shipboard installations—ship-motion computations. The predictor cabinet also contains interface electronics for the radar and gun and, on board ship, the central vertical reference, compass and log. The predictor is particularly good at smoothing out glint. The present 4,000-word memory will be doubled in production equipment.

- A weapon-control console (WCC) incorporating the display and control units for automatic operation of the radar, predictor and gun. The WCC includes a mode-control panel for selection of the desired type of engagement (anti-aircraft, surface or naval gunfire support) and a keyboard panel for insertion of ballistic, meteorological and associated information. Firing is initiated by an operator, sitting at the WCC, who depresses a foot switch.

Sapphire will control servo-operated guns, naval or land-based, with calibres from 20mm upwards.

Trials are due to take place in October of Sapphire coupled with a Saab TVT-300 automatic contrast-tracking television system. This equipment would provide a second independent source of information to the predictor, allowing complete engagements to be carried out using either radar or TV tracking as circumstances demanded.



The indication and predictor panels for Sapphire